

UNIVERSITI TEKNOLOGI MARA

**DUAL FUNCTION
INTEGRATED MONOPOLE
MICROSTRIP PATCH ANTENNA
WITH
LIGHT EMITTING DIODE**

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science
(Electrical Engineering)

Faculty of Electrical Engineering

January 2020

ABSTRACT

Wireless technology is going through expansive research and development. Thus the antenna design should be further innovated as it is the fundamental of wireless system. The integration between the antennas with other element are needed to create more functional variation of the antenna. Antenna with Light Emitting Diode (LED) is introduced to create dual functional antenna, where antenna itself which can transmit and receive signal and as light source at the same time. As government has launched Green Building Index which is a subset of National Green Technology Policy, LED is a part of transforming to more efficient lighting source in energy utilisation category. Thus, this creates opportunity to present LED integrated antenna as a further innovation of antenna and lighting and as one of the solution for a green technology. The research described in this thesis focuses on the development of the integration between Monopole Microstrip Patch Antenna with Light Emitting Diode (LED) and to investigate the effect of Light Emitting Diode to the antenna performance. In this project, two designs of the integration between antennas with LED were proposed. Design 1 is the starting point to understand the effects of adding LED to the antenna. In Design 1, the monopole antenna at 3.6GHz and 5 LED is added in series circuit to increase the length of the antenna. The fabrication results shows that, when there is no LED is added into the antenna structure, the frequency is at 3.693 GHz with the value of S11 is -27.95 dB. After 5 LED is integrated with the monopole, the frequency change to 1.608 GHz with S11 is -16.32 dB. The result shows that as the length of the antenna increase, the frequency will go inversely proportional. For Design 2, it is the solution to overcome the issue of voltage from Design 1 where the LED in series connection require higher voltage which is about 15 V. Therefore, for Design 2, LED is being setup in parallel connection whereby parasitic element is added to act as anode and cathode for the integrated LED. With the installation of LED in parallel, there is a reduction of total voltage utilised to 3 V only and also the effect of LED to antenna shows the decreasing frequency shift form 4.10 GHz with S11 is -20.13dB to 3.88 GHz with S11 is -18.87 dB with the increasing number of LED. To design the antenna structure, Computer Simulation Technology (CST) is used with the permittivity, $\epsilon_r = 4.3$ thickness, $h = 1.6\text{mm}$ on FR4 substrate. The SMD5050 LED is used in all of the designs. All the results regarding to the effects of adding the LED into the antenna structure of antenna had been determined through the performance of antenna in terms of reflection coefficient, gain, directivity and the efficiency.

ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious the Most Merciful

Bismillahirrahmanirahim. First of all, I would like to thank my supervisor, Prof. Ts Dr.Mohd Tarmizi for the patient guidance, encouragement and advice he has provided throughout my time as his student. I have been extremely lucky to have a supervisor and a mentor who cared so much about my work, and who responded to my questions. I would also like to thank all the members of Antenna Research Center (ARC) who helped me in laboratory work throughout these years. Completing this work would have been all the more difficult were it not for the support and friendship provided by the members of ARC.

I must express my gratitude to Sabree, my husband, for his continuous support and encouragement. I was continually amazed by his willingness to proof read countless pages of my thesis, and by being there through thick and thin. And by the patience of my family members who encouraged me, and experienced all of the ups and downs of my research and being understanding.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

In recent years, there are an increasing need of wireless communication and it goes on increasing exponentially. To work on such demand, there is the need to develop wireless system with compact antenna structure. Monopole antenna is a good candidate for wireless communications services where it offer the compact simple structure, omnidirectional pattern (depends on the application) and ease of fabrication [1] and [2]. The use of the monopole antenna nowadays basically is used for indoor wireless application local area network (WLAN) communication. In advance, the monopole antennas are used in wireless body area network (WBAN) which it becomes an important component in the medical device market especially medical application [3] and [4]. The development of monopole antenna has introduced a lot of techniques which have been implemented by other researchers. Most of them are concerned to enhance the monopole antenna performance especially in terms of increasing the gain of the antenna [2] operating frequency and widen the bandwidth of the antenna [1].

In addition, the improvement of the monopole antenna, does not only focus on single frequency but it can provide a multiband frequency as well that can be used in many applications. For example [1] whereby the monopole antenna can be utilized in various applications such as Long Term Evolution (LTE) or 4G, Bluetooth, Wireless Local Area Network or W-LAN and upper UWB band in one single device. With these capabilities of monopole antenna, besides of having more than one usage, it also reduce the weight, cost, material required, and space thus, giving more values to users

Nowadays, the trend in integrated circuit technologies are in trend that has created another revolution for antenna field. The concept of integration in simpler terms is having two separate functions combined into one structure. The concept of integration is important because of efficient use of space and also space saving, reduction of the manufacturing costs and increase the value or improving the antenna. Recently, the integration between antennas with light emitting diode is introduced to enhance the usability of the antenna. The purpose to integrate this two difference